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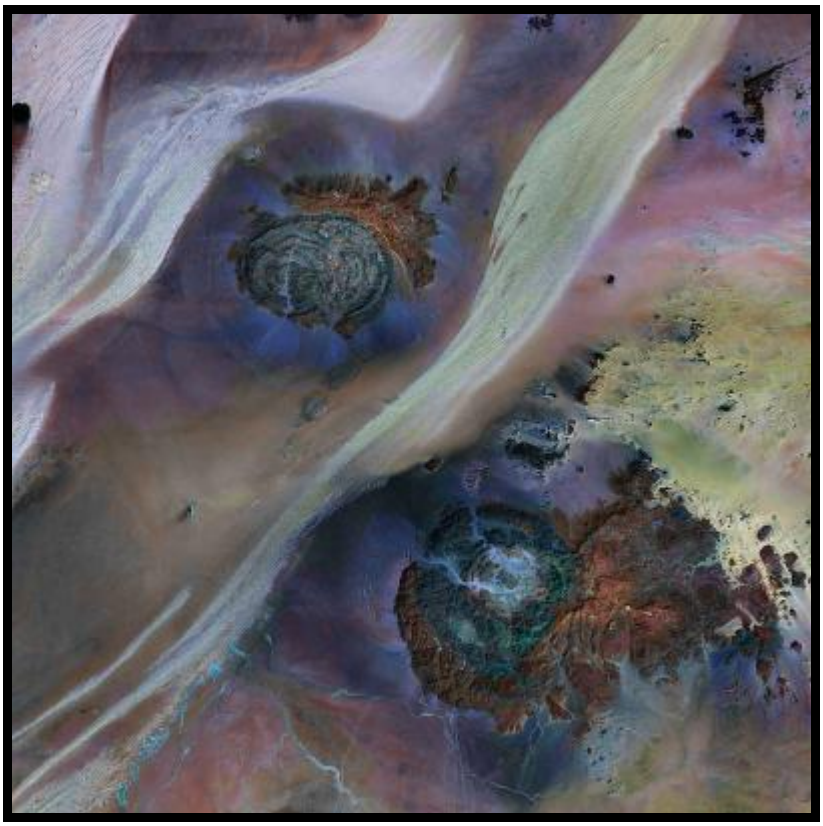
Risø-I-2416(EN)

Egypt satellite images for land surface characterization

C.B. Hasager



Risø National Laboratory
Roskilde
Denmark
November 2005

Author: C.B. Hasager
Title: Egypt satellite images for land surface characterization
Department: Wind Energy Department

Abstract (max. 2000 char.):
Satellite images provide information on the land surface properties. From optical remote sensing images in the blue, green, red and near-infrared part of the electromagnetic spectrum it is possible to identify a large number of surface features. The report briefly describes different satellite images used for mapping the vegetation cover types and other land cover types in Egypt. The mapping ranges from 1 km resolution to 30 m resolution. The aim is to provide satellite image mapping with land surface characteristics relevant for roughness mapping.

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Cover:
Colour maps from Landsat TM are available at https://zulu.ssc.nasa.gov/mrsid/mrsid.pl The N-35-20-2000 tile is shown in 12% zoom in false-colour.

Pages: 18
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Contents

Preface

Satellite images from optical remote sensing instruments are available from many sources. The images are processed to land cover type maps through classification analysis. In the present report available maps covering Egypt in different resolutions from 1 km to 30 m are presented. Each land cover type has to be associated with a roughness length.

1 Introduction

The aim is to provide satellite images mapping Egypt to the project. The images should provide land surface characteristics relevant for roughness mapping.

1.1 Method

Surface roughness is assumed to relate to each specific land cover type. Therefore it is important to distinguish between land cover types that each has a unique roughness. Land cover type and associated roughness typically is taken from tabulated values or from field data on roughness and land cover type.

For Egypt, i.e. an area of around 1.000.000 km^2, it is feasible to use tabulated values for the full domain. For local areas, it is possible to identify the roughness from field visits combined with high-resolution satellite land cover maps.

At the national scale for Egypt and local scale, the method applied is land cover classification analysis. The mapping is based on optical satellite images recorded in different bands, typically green, red and near-infrared (NIR) bands. Other bands such as blue and short-wave infrared (SWIR) bands can also be included in the analysis.

Several options are open when looking for freely available satellite images and derived products e.g. land cover maps.

Land cover maps produced by e.g. satellite agency or other institutes with expertise on satellite data analysis are available at resolutions of 1 km grid cells for Egypt. This is so-called low resolution.

Presently two low-resolution data sources are found based on:

- NOAA AVHRR Pathfinder satellite images from year 1992 to 1993.
- MODIS Terra and Aqua satellite images from after year 2000.

Land cover maps at medium resolution, 250 m and 500 m, potentially can be produced from MODIS Terra and Aqua images. It requires processing from ‘raw’ satellite image data to land cover maps. Here ‘raw’ may be understood e.g. as calibrated and geometrically rectified satellite images in single bands. The analysis includes a statistical treatment for classification of the various bands.

Land cover maps at high resolution, 30 m, can be produced from satellite images from

- Landsat-5 TM since March 1984 to present
- Landsat-7 ETM+ since April 1999 to present, however with reduced image quality since May 2003.

The processing has to be based on ‘raw’ satellite images.

2 Low-resolution land cover maps

2.1 Global Land Cover Characteristics (GLCC)

The NOAA AVHRR Pathfinder satellite images have been used to generate the Global Land Cover Characterisitcs (GLCC) at http://edcdaac.usgs.gov/glcc/glcc.asp.

- GLCC is available in Version 1.2 from 1997
- GLCC is available in Version 2.0 from 2003.

GLCC map is currently used in the KAMM model for description of land cover roughness. The spatial resolution is 1 km.

2.2 MODIS Land Cover map (MOD12Q1 Land Cover Product)

The map is based on MODIS Terra and Aqua satellite data. The MODIS sensor onboard Terra and Aqua platforms are specifically dedicated to the mapping land surface parameters hence the spectral bands are improved for this task compared to e.g. NOAA AVHRR. The latter series is operational meteorological satellites.

The original source is http://edcimswww.cr.usgs.gov/pub/imswelcome/

The MOD12Q1 Land Cover Product (MODIS/Terra Land Cover 96 Day L3 Global 1 km ISIN Grid) supplies an IGBP land cover classification map of the globe along with an assessment of the quality or confidence that is placed in that classification. It is 1 km resolution data.

The data can be access different ways either through

- http://edcimswww.cr.usgs.gov/pub/imswelcome/

This is the official site. The MOD12Q1 2001001 V004 data were released at the EDC DAAC on April 16, 2004. The data set name to search is "MODIS/TERRA LAND COVER TYPE 96-DAY L3 GLOBAL 1KM ISIN GRID V004". A global extent search should return 317 land tiles.

The data are also accessible at

- http://geography.bu.edu/landcover/userguidelc/lc.html#sds

An accessible at

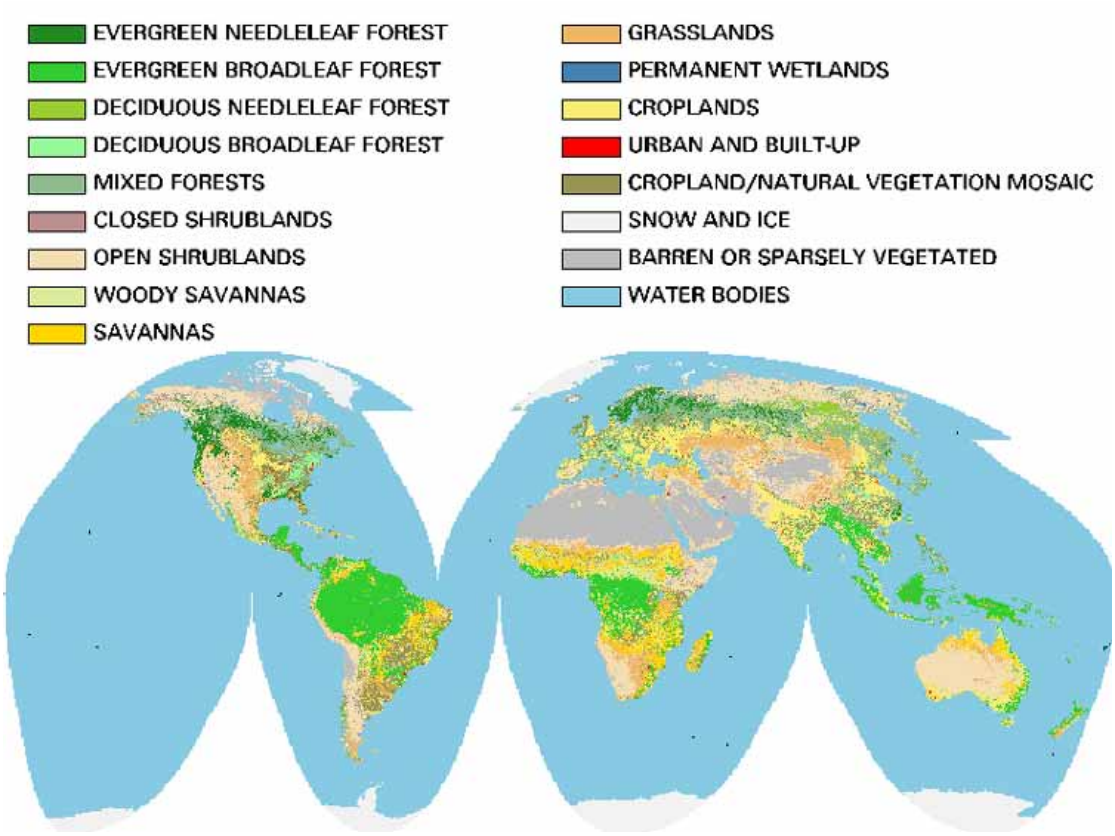
- http://duckwater.bu.edu/lc/

It is re-projected mosaic exports from NASA Terra/Modeis HDF- EOS MOD12Q1 V004 products. It is binary files flat 8 bit layers compressed with the GNU "gzip" utility. Associated ASCII text metadata files are provided. **CAVEAT:** These files are provided as a courtesy to users having difficulty with the officially released data. These are not the official data product releases. **LARGE FILE WARNING!** Note the file sizes and consider your bandwidth before you click on a data link!

General information on MOD12Q1 from
http://edcdaac.usgs.gov/modis/mod12q1.asp

Area = 10° x 10° lat/long (tiles size)
Size = 1200 x 1200 rows/columns
File Size = ~23 MB
Resolution = 1 kilometer
Projection = Integerized Sinusoidal
Emissivity Data Type = 8-bit Unsigned Integer
Data Format = HDF-EOS
Science Data Sets (SDS) = 16

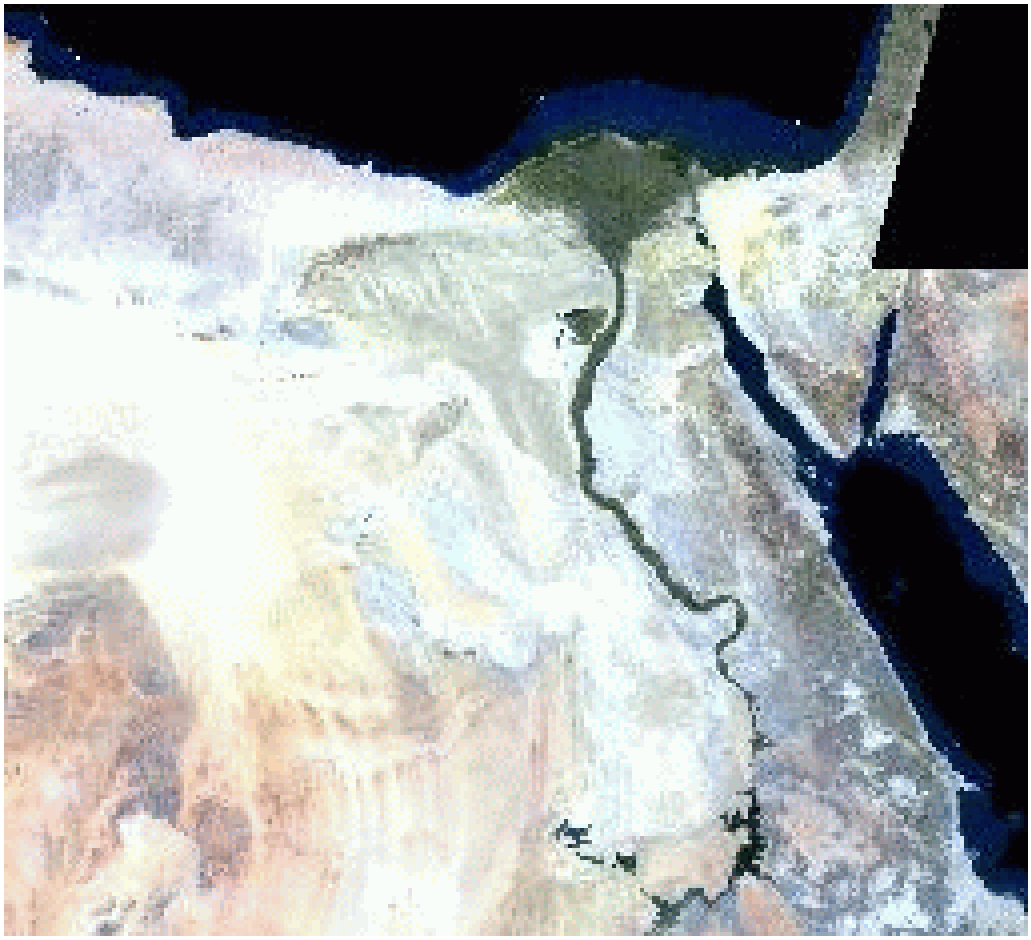
The Land Cover Classification product, MOD12Q1, identifies 17 classes of land cover in the International Geosphere-Biosphere Programme (IGBP) global vegetation classification scheme. The global map is shown below.



3 Low-resolution colour maps of Egypt

True colour maps display red, green and blue bands in RGB, respectively. In case the bands are shown differently it is false-colour, e.g. red, green and NIR in RGB, respectively.

Egypt seen by MODIS Terra in true-colour (here in jpg but nicer in tiff)



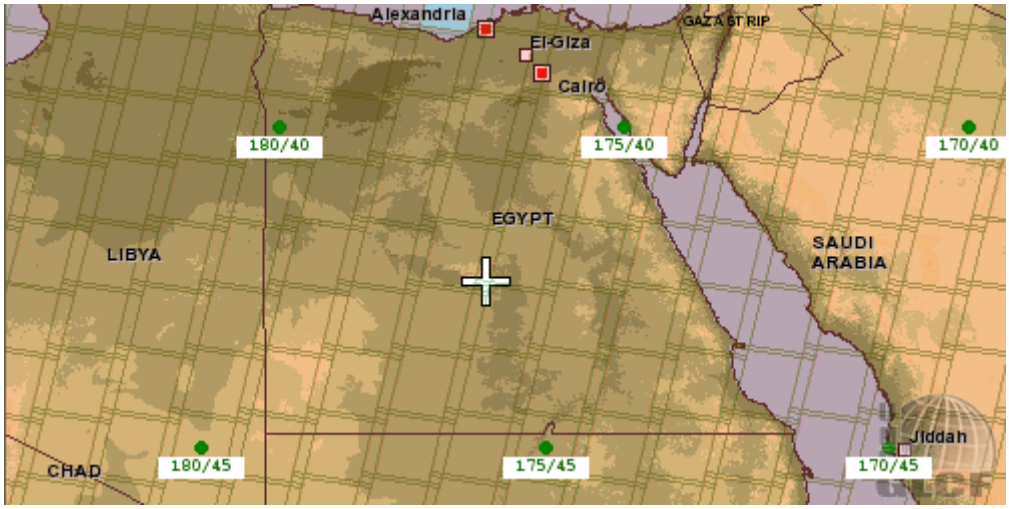
4 Medium-resolution land cover maps

MODIS Terra and Aqua 'raw' data can be used to produce land cover maps at 500 m and 250 m resolution. Several products on vegetation characteristics and changes are readily available at this resolution. However a global (Egypt) land cover map is not.

5 High-resolution land cover maps

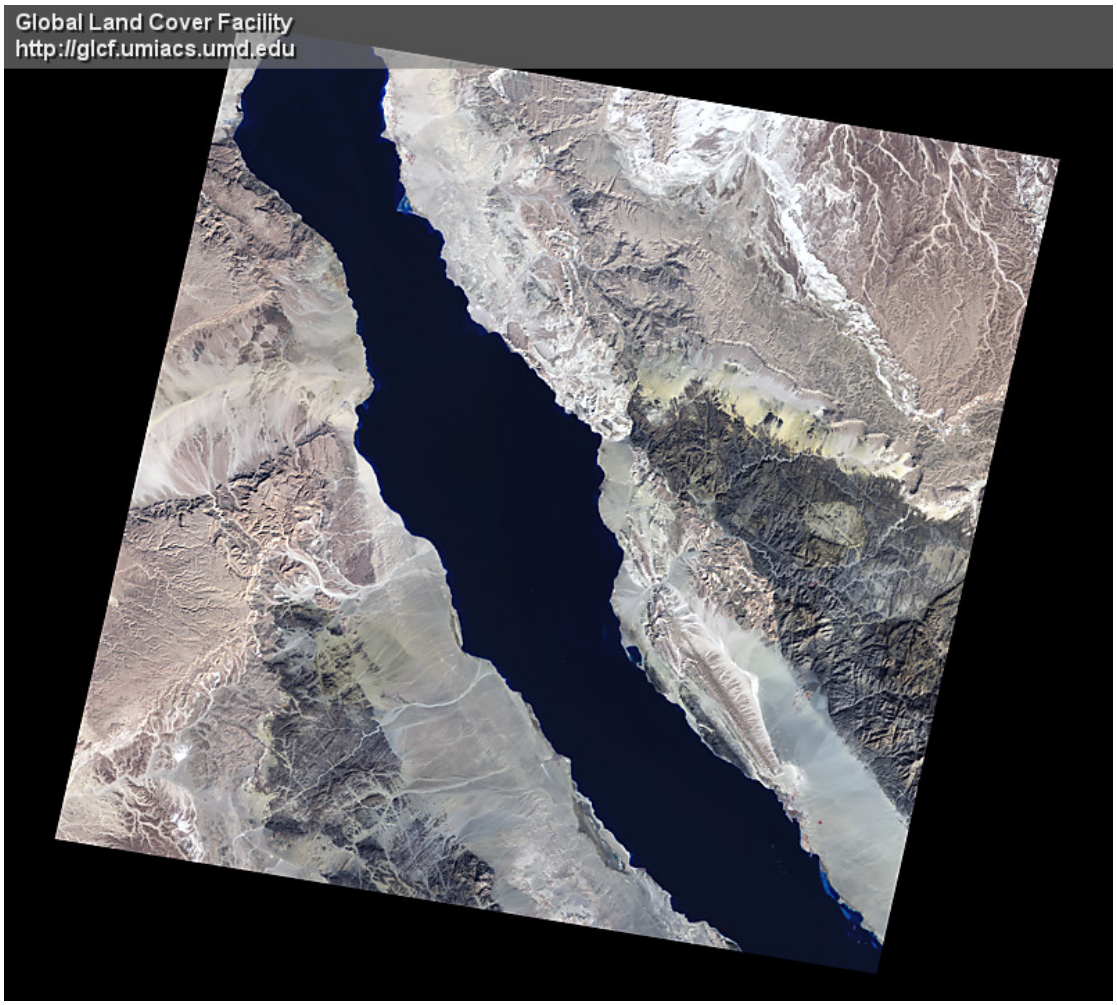
To achieve high-resolution land cover maps for Egypt it is necessary to retrieve Landsat-5 TM and Landsat-7 ETM+ satellite images from http://www.landcover.org/index.shtml. There are 27.748 images in the archive. They are free of charge and the bands can be downloaded separately. This is a necessary requirement for land cover classification analysis.

For Egypt the Landsat path and rows are shown below. Each scene covers 100 km by 100 km with a resolution of 30 m by 30 m. There are six bands available (1,2,3,4,5,7). Band 6 is a thermal band and not useful in general for land cover classification. To the northwest it is path 180, row 38 and to the southeast path 178, row 45.

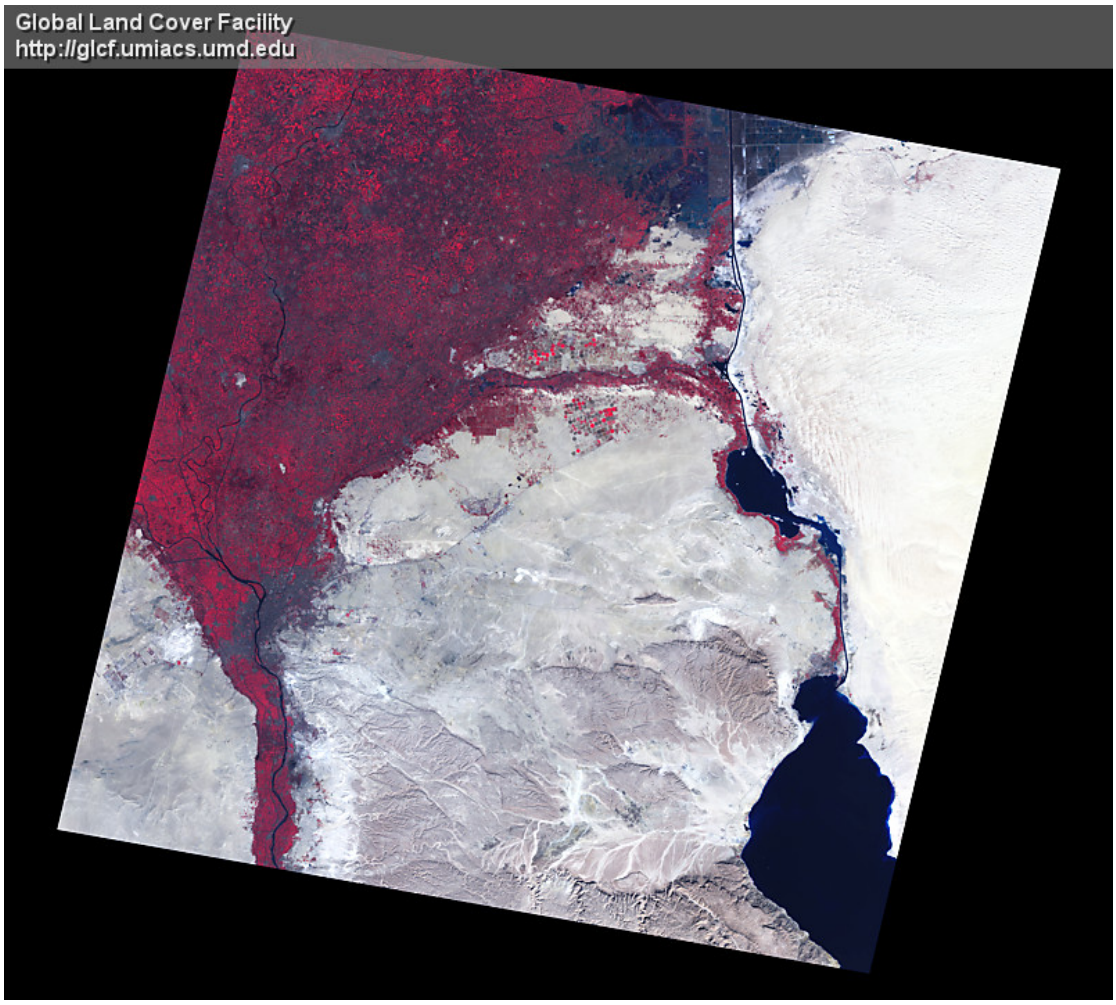


Some examples of data from the archive are given below.

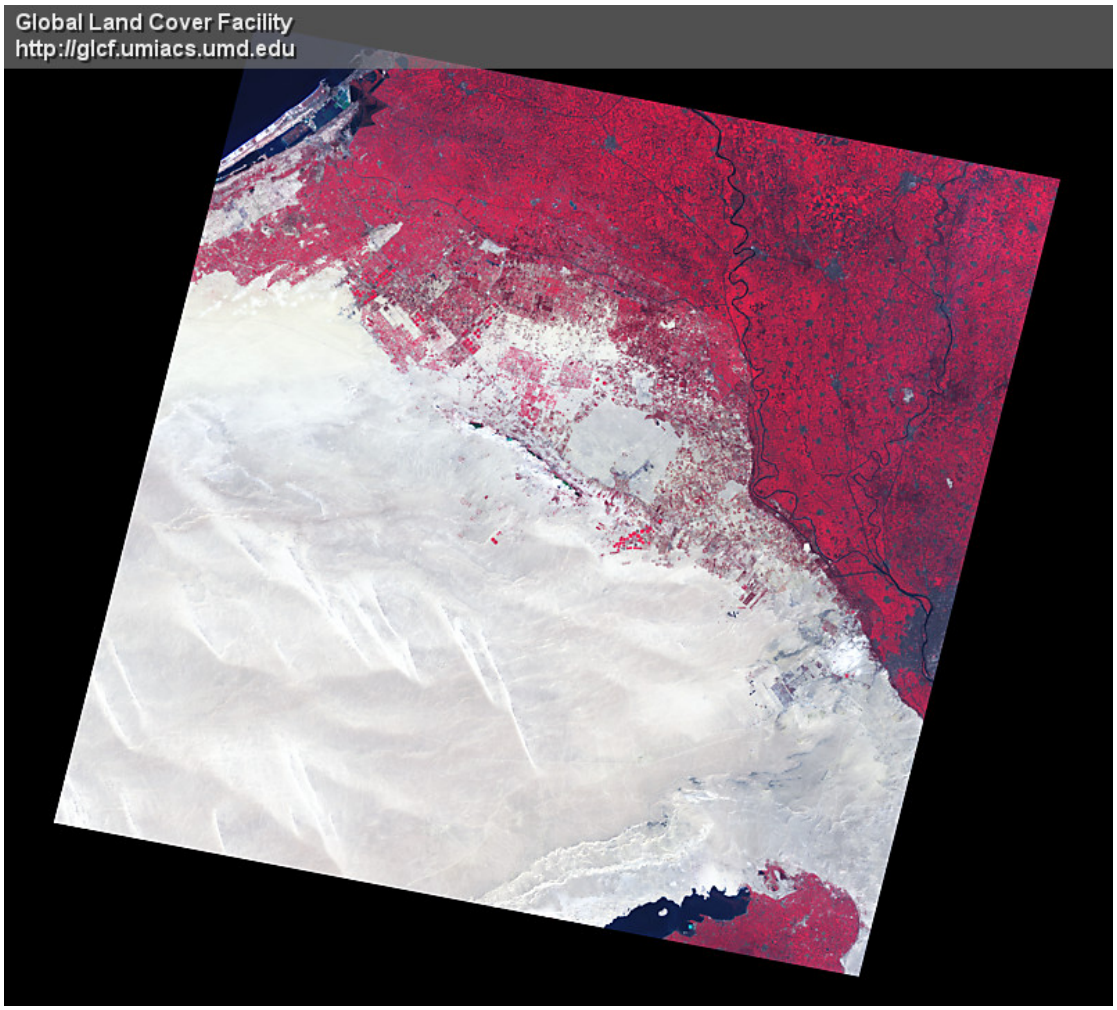
2000-12-22, path 175, row 40, Landsat ETM+



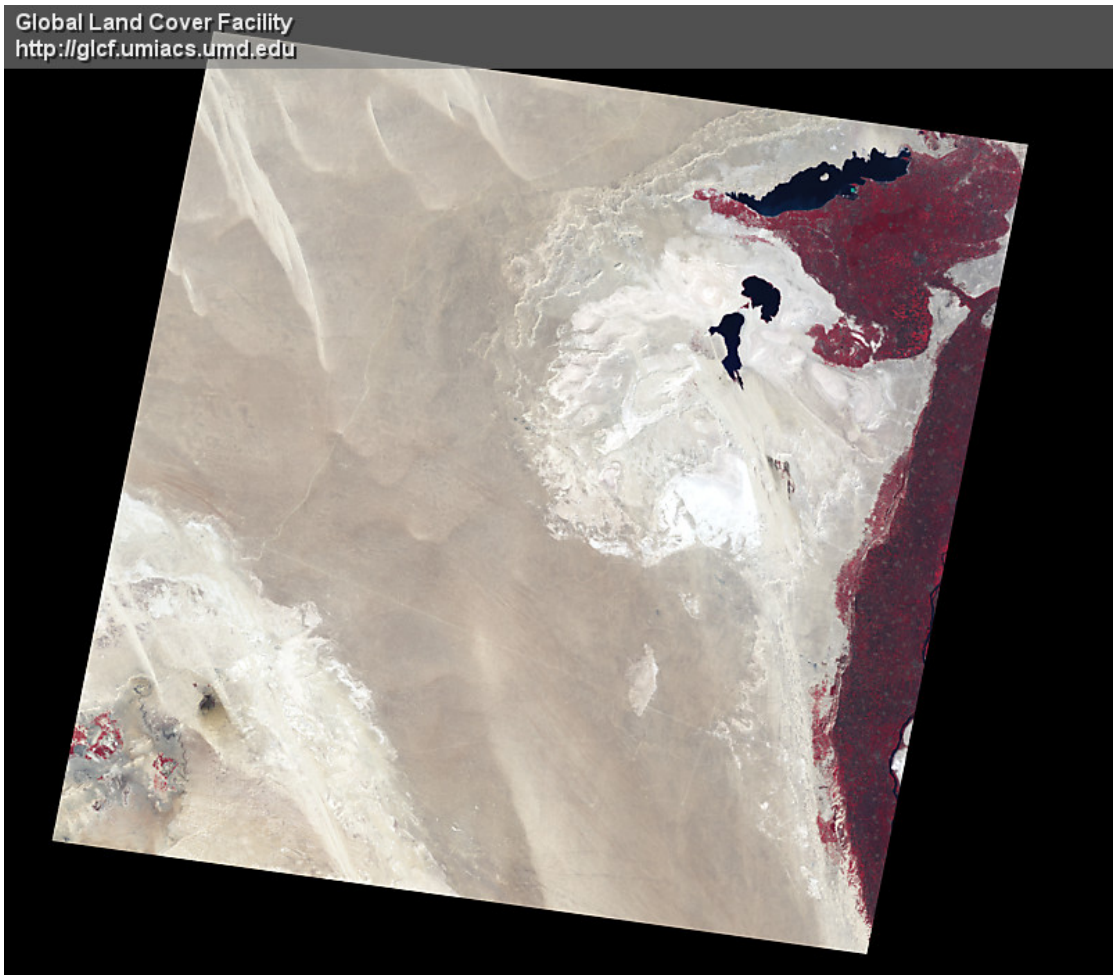
2000-11-11, path 176, row 39, Landsat ETM+



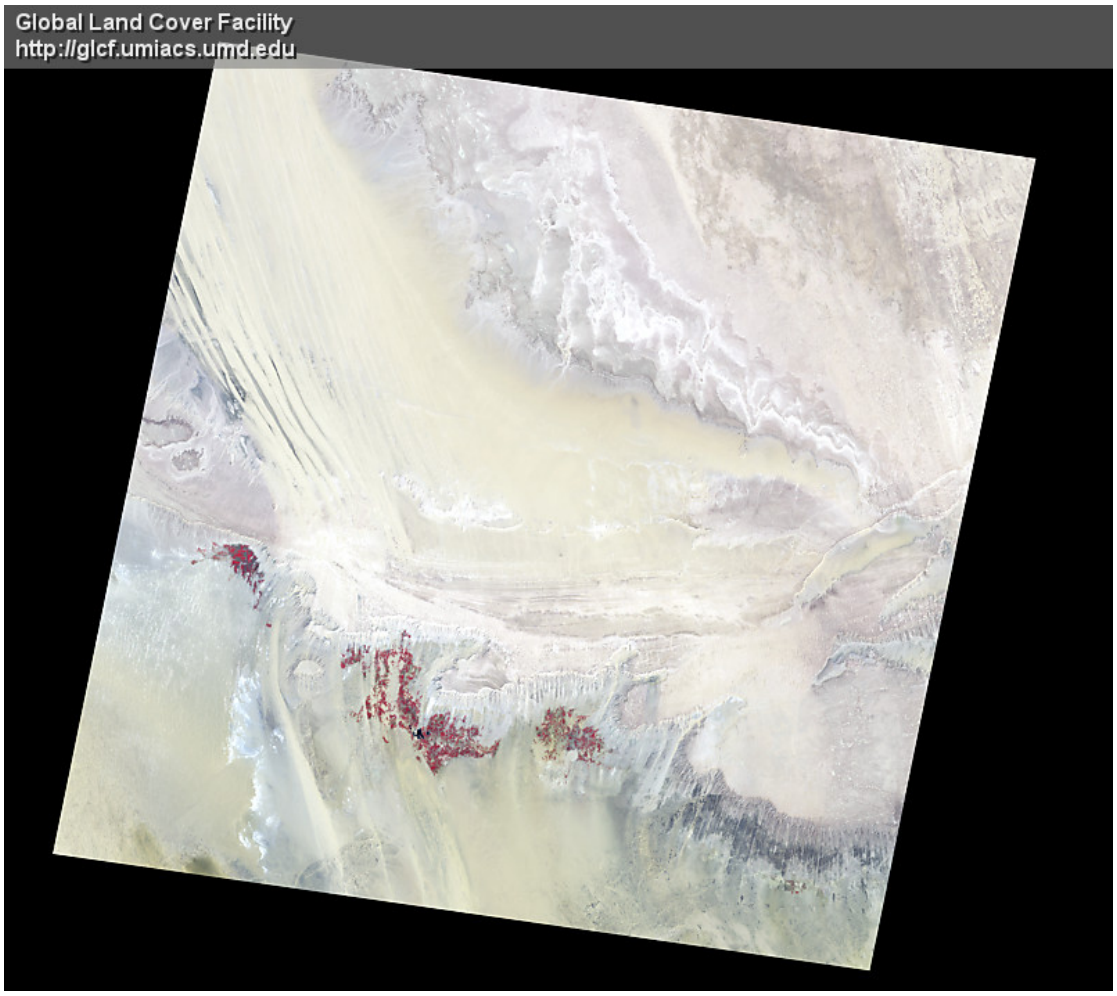
2001-12-23, path 177, row 39, Landsat ETM+



2001-10-04, path 177, row 40, Landsat ETM+

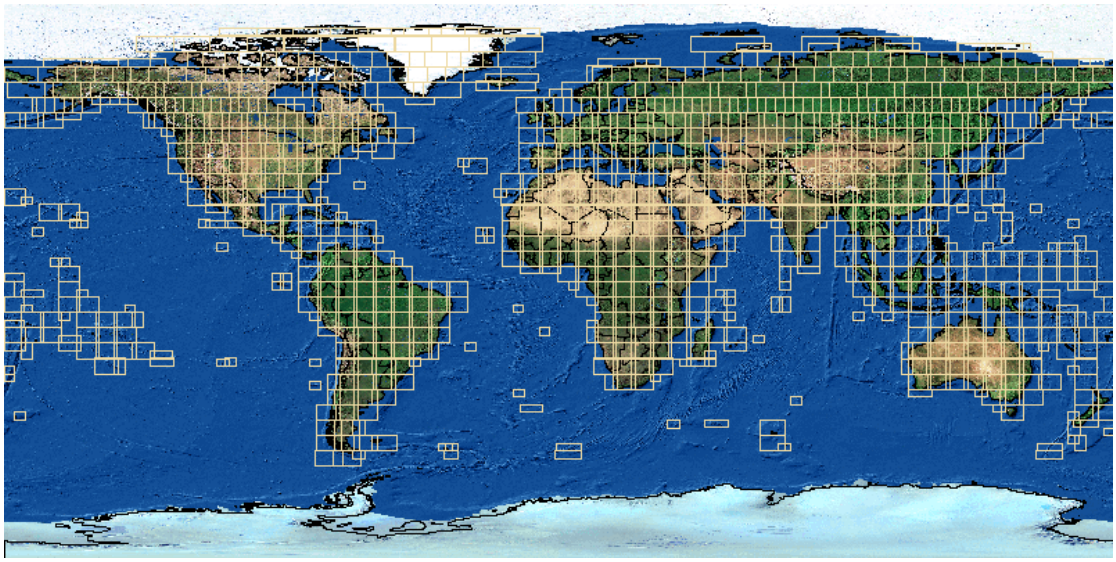


2001-10-40, path 177, row 42, Landsat ETM3

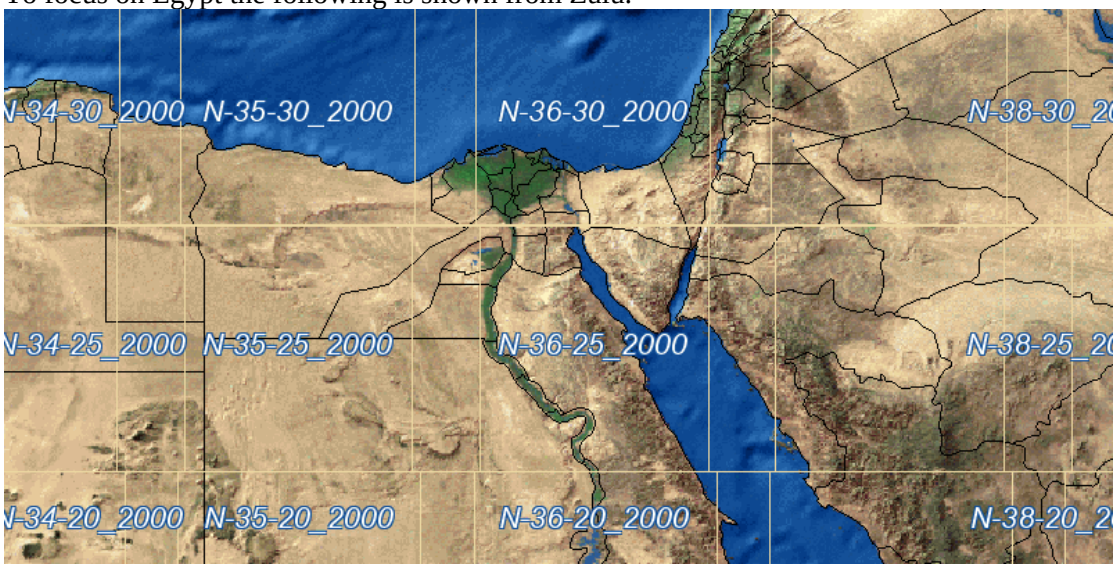


6 High-resolution colour maps of Egypt

Colour maps from Landsat TM are available at
https://zulu.ssc.nasa.gov/mrsid/mrsid.pl
The data are given as true-colour or false-colour (not with individual bands accessible). It may be of help to identify certain phenomena, yet not useful for classification analysis for land cover mapping. Below is shown the coverage.

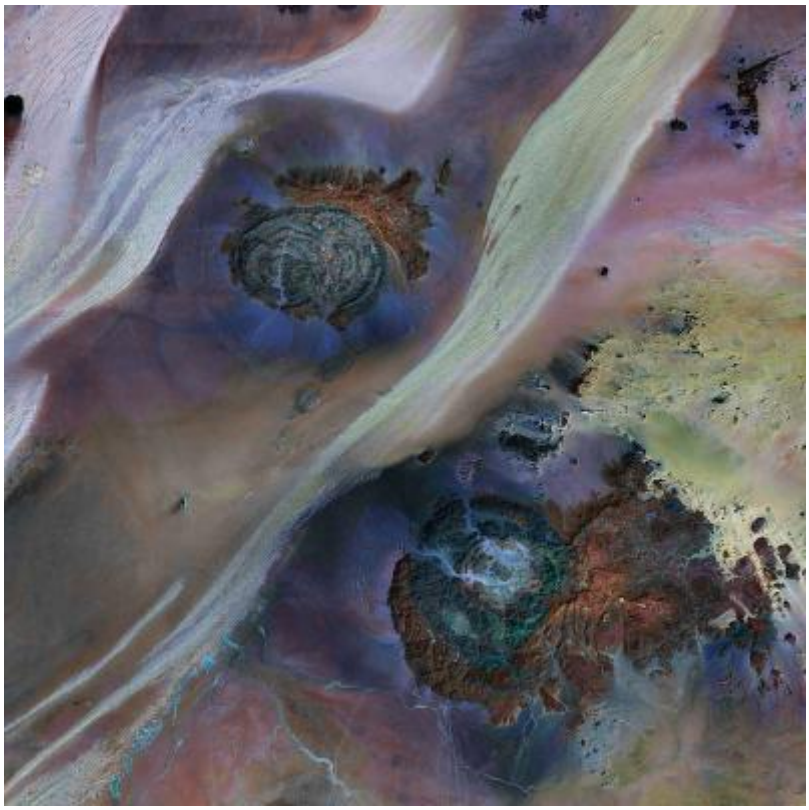


To focus on Egypt the following is shown from Zulu.

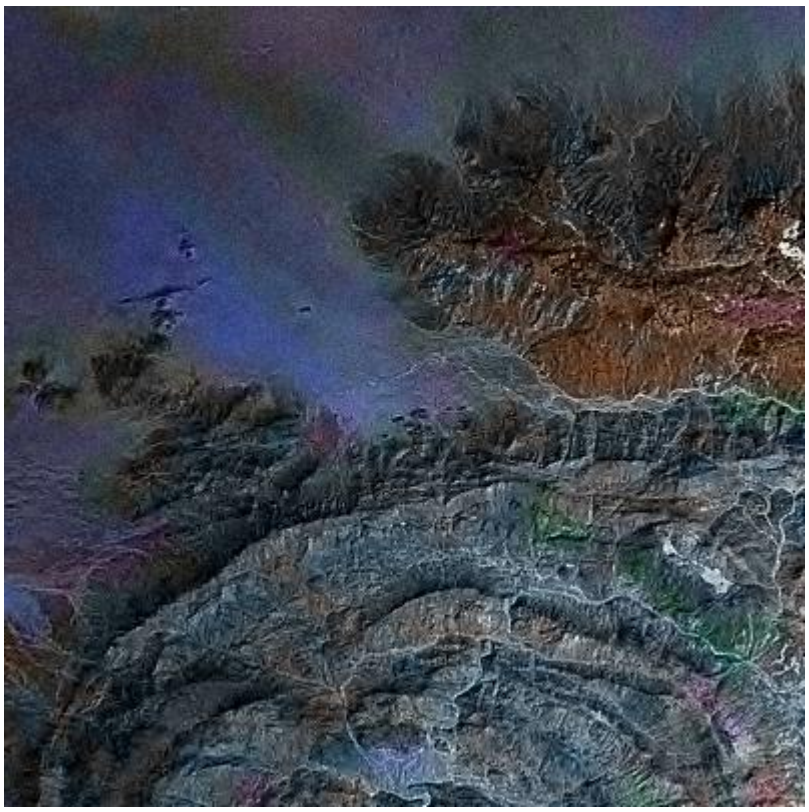


The full N-35-20-2000 tile is shown in the next three figures in false-colour.

Shown in full resolution



Shown in zoom of 12%



Shown in zoom of 100%

7 Summary

The satellite images freely available through the web allow a detailed land cover mapping of Egypt to be downloaded at low-resolution (1 km) and obtained through land cover classification at high-resolution (30 m).

Readily available are the three low-resolution land cover maps at 1 km resolution:

- GLCC version 1.2 (from 1997)
- GLCC version 2.0 (from 2003)
- MOD12Q1 (from April 2004)

Landsat-5 TM and Landsat-7 ETM+ satellite images with 6 bands dedicated to land cover classification are available for Egypt. The resolution is 30 m.

True-colour and false-colour maps of Egypt are available from several sources and at several resolutions. Examples from MODIS Terra and Landsat ETM+ are shown in the present report. Several more are available.

Mission

To promote an innovative and environmentally sustainable technological development within the areas of energy, industrial technology and bioproduction through research, innovation and advisory services.

Vision

Risø's research **shall extend the boundaries** for the understanding of nature's processes and interactions right down to the molecular nanoscale.

The results obtained shall **set new trends** for the development of sustainable technologies within the fields of energy, industrial technology and biotechnology.

The efforts made **shall benefit** Danish society and lead to the development of new multi-billion industries.